Efficiency & Conservation

EFFICIENCY CONSERVATION

INTRODUCTION

The United States uses a lot of energy—nearly a million dollars worth of energy each minute, 24 hours a day, every day of the year. With less than five percent of the world's population, we consume almost one quarter (24 percent) of the world's energy resources. We are not alone among industrialized nations; 16 percent of the world's population consumes 80 percent of its natural resources.

The average American consumes six times the world average per capita consumption of energy. Every time we fill up our vehicles or open our utility bills, we are reminded of the economic impacts of energy.

ENERGY EFFICIENCY & CONSERVATION

Energy is more than numbers on a utility bill; it is the foundation of everything we do. All of us use energy every day—for transportation, cooking, heating and cooling rooms, manufacturing, lighting, water-use, and entertainment. We rely on energy to make our lives comfortable, productive and enjoyable. Sustaining this quality of life requires that we use our energy resources wisely. The careful management of resources includes reducing total energy use and using energy more efficiently.

The choices we make about how we use energy—turning machines off when not in use or choosing to buy energy efficient appliances—will have increasing impacts on the quality of our environment and lives. There are many things we can do to use less energy and use it more wisely. These things involve energy conservation and energy efficiency. Many people use these terms interchangeably; however, they have different meanings.

Energy conservation includes any behavior that results in the use of less energy. Energy efficiency involves the use of technology that requires less energy to perform the same function. A compact fluorescent light bulb that uses less energy to produce the same amount of light as an incandescent light bulb is an example of energy efficiency. The decision to replace an incandescent light bulb with a compact fluorescent is an example of energy conservation.

The U.S. Department of Energy divides the way we use energy into three categories—residential and commercial, industrial, and transportation. As individuals, our energy choices and actions can result in a significant reduction in the amount of energy used in all three sectors of the economy.

RESIDENTIAL/COMMERCIAL

Households use about one-fifth of the total energy consumed in the United States each year. The typical U.S. family spends almost $1,300 a year on utility bills.

Representative Countries & Energy Usage-2002

Country	Population in millions	Energy Consumption in quads
China	1295	43.2
India	1050	14.0
United States	288	97.4
Brazil	176	8.6
Pakistan	150	1.8
Russia	144	27.5
Bangladesh	144	0.6
Japan	128	22.0
Nigeria	121	0.9
Mexico	102	6.6
Germany	82	14.3
France	60	11.0
United Kingdom	59	9.6
Italy	58	7.6
South Korea	47	8.3
Canada	31	13.1

About 60 percent is in the form of electricity; the remainder comes mostly from natural gas and oil.

Much of this energy is not put to use. Heat, for example, pours out of homes through drafty doors and windows and under-insulated attics, walls, floors, and basements. Some idle appliances use energy 24 hours a day. The amount of energy lost through poorly insulated windows and doors equals the amount of energy flowing through the Alaskan oil pipeline each year.

Energy-efficient improvements can not only make a home more comfortable, they can yield long-term financial rewards. Many utility companies and energy efficiency organizations provide energy audits to identify areas where homes are poorly insulated or energy inefficient. This service may be provided free or at low cost.

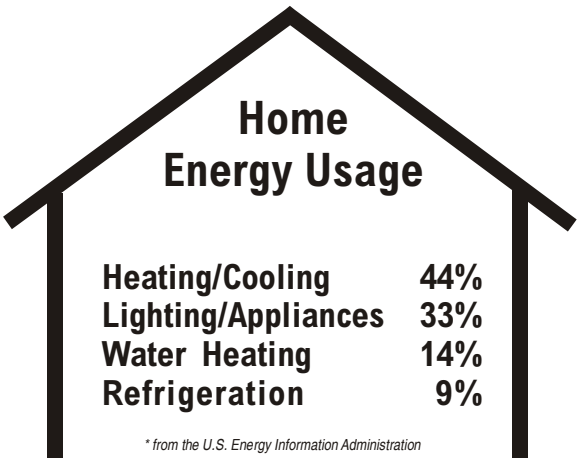
Household operations account for 35 percent of the greenhouse gas emissions that contribute to global climate change and 32 percent of the common air polluting emissions. The average home contributes up to two times as much carbon dioxide as the average automobile. Using a few inexpensive energy-efficient measures can reduce the average energy bill by 10 to 50 percent and, at the same time, reduce air pollution.

Heating and Cooling

Introduction

Heating and cooling systems use more energy than any other systems in American homes. Natural gas and electricity are used to heat most American homes, electricity to cool almost all. Typically, 44 percent of the average family's utility bills goes to keeping homes at a comfortable temperature. The energy sources that power these heating and cooling systems emit more than 500 million tons of carbon dioxide into the atmosphere each year. They also generate about 24 percent of the nation's sulfur dioxide and 12 percent of the nitrogen oxide emissions, the active components in acid rain.

With all heating, ventilation, and air-conditioning systems, you can save money and increase comfort by installing proper insulation, maintaining and upgrading equipment, and practicing energy-efficient behaviors. By combining proper maintenance, upgrades, insulation, weatherization, and thermostat management, you can reduce energy bills and emissions by half. A two-degree adjustment to your thermostat setting (lower in winter, higher in summer) can lower heating bills by four percent and prevent 500 pounds of carbon dioxide from entering the atmosphere each year. Programmable thermostats can automatically control temperature for time of day and season for maximum efficiency.



Insulation and Weatherization

Warm air leaking into your home in cooling seasons and out of your home in heating seasons can waste a substantial amount of energy. You can increase home comfort and reduce heating and cooling needs by up to 30 percent by investing a few hundred dollars in proper insulation and weatherization products. Insulation is rated using an R-value that indicates the resistance of the material to heat flow. You need a minimum R-value of 26, or more than three inches of insulation, in ceilings and walls. In very cold climates, a higher R-value is recommended.

Insulation wraps your house in a nice warm blanket, but air can still leak in or out through small cracks. Often the effect of the many small leaks in a home is equivalent to a wide open door. One of the easiest money-saving measures you can perform is to caulk, seal, and weather-strip all seams, cracks, and openings to the outside. You can save 10 percent or more on your energy bill by reducing the air leaks in your home.

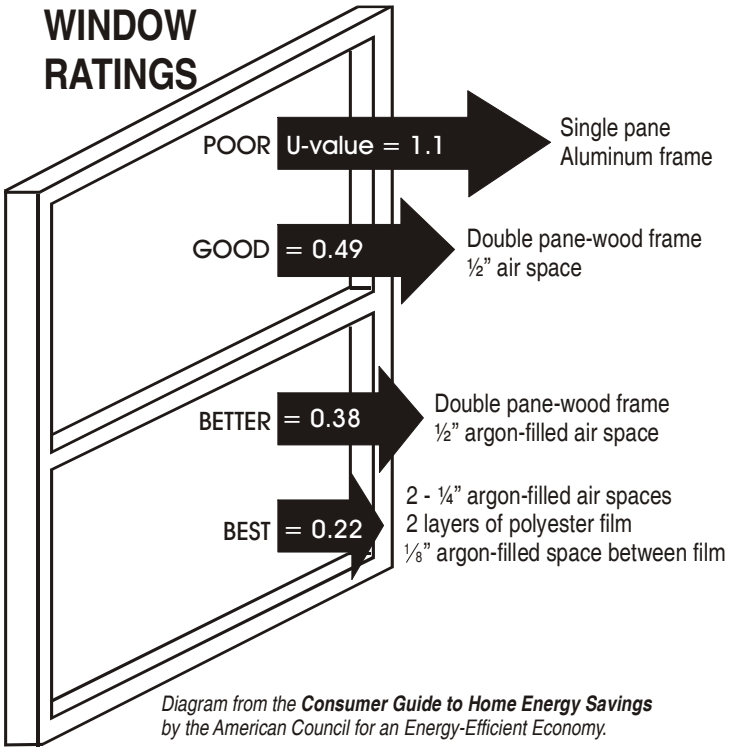


*Diagram from the **Consumer Guide to Home Energy Savings** by the American Council for an Energy-Efficient Economy.*

Doors and Windows

About one-third of a typical home's heat loss occurs around and through the doors and windows. Energy-efficient doors are insulated and seal tightly to prevent air from leaking through or around them. If your doors are in good shape and you don't want to replace them, make sure they seal tightly and have door sweeps at the bottom to prevent air leaks. Installing insulated storm doors provides an additional barrier to leaking air.

Most homes have more windows than doors. Replacing older windows with energy-efficient ones can significantly reduce air leaks and utility bills. The best windows shut tightly and are constructed of two or more pieces of glass separated by a gas that does not conduct heat well. The National Fenestration Rating Council has developed a rating factor for windows, called the U-factor, that indicates the insulating value of windows. The lower the U-factor, the better the window is at preventing heat flow through the window.

Windows, doors, and skylights are part of the government-backed EnergyStar® program that certifies energy-efficient products. To meet EnergyStar® requirements, windows, door and skylights must meet requirements tailored for the country's three broad climate regions. Windows and doors in the northern states must have a U-factor of 0.35 or less; in the central climate, a U-factor of 0.40 or less, and in the southern climate, a U-factor of 0.75 or less. They must also meet other criteria that measure the amount of solar energy that can pass through them.

If you cannot replace older windows, there are several things you can do to make them more energy efficient. First, caulk any cracks around the windows and make sure they seal tightly. Add storm windows or sheets of clear plastic to the outside to create additional air barriers. You can also hang insulated drapes on the inside—during heating seasons, open them on sunny days and close them at night. During cooling seasons, close them during the day to keep out the sun.

Landscaping

Although it isn't possible to control the weather, certain landscape practices can modify its impact on home environments. By strategically placing trees, shrubs, and other landscape structures to block the wind and provide shade, residents can reduce the energy needed to keep their homes comfortable during heating and cooling seasons. If the landscaping is well done, residents receive the additional benefits of beauty and increased real estate values. A well-planned landscape is one of the best investments a homeowner can make.

Electricity & Appliances

Appliances account for about 20 percent of a typical household's energy consumption, with refrigerators, clothes washers, and dryers at the top of the consumption list. When you shop for new appliances, you should think of two price tags. The first one covers the purchase price—consider it a down payment. The second price tag is the cost of operating the appliance during its lifetime. You'll be paying that second price tag on your utility bill every month for the next 10 to 20 years, depending on the appliance. Many energy efficient appliances have higher initial purchase costs, but save significant amounts of money in lower energy costs. Over the life of an appliance, an energy-efficient model is always a better deal.

When you shop for a new appliance, look for the EnergyStar® label—your assurance that the product saves energy. EnergyStar® appliances have been identified by the U.S. Environmental Protection Agency and Department of Energy as the most energy-efficient products in their classes. If the average American were to equip his/her home only with products that have the EnergyStar® label, he/she would cut his energy bills, as well as greenhouse gas emissions, by about 30 percent. A list of these appliances can be found on the EnergyStar® website at www.energystar.gov.

Another way to determine which appliance is more energy efficient is to compare energy usage using EnergyGuide labels. The federal government requires most appliances to display bright yellow and black EnergyGuide labels. Although these labels do not tell you which appliance is the most efficient, they will tell you the annual energy consumption and average operating cost of each appliance so you can compare them.

Refrigerators, for example, account for about 20 percent of household electricity use. Replacing an older refrigerator with a new energy-efficient model can save significantly on energy bills, as well as emissions. With older models, a large amount of electricity can be saved by setting the refrigerator temperature at 37 degrees, the freezer temperature at three (3) degrees, and making sure that the energy saver switch is operational and in use.

Refrigerators should also be airtight; make sure the gaskets around the doors are clean and seal tightly. Close the door on a piece of paper—if you can easily pull out the paper when the door is closed, you need to replace the gaskets.

Lighting

As a nation, we spend about one-quarter of the electricity we use on lighting, at a cost of more than $37 billion annually. Much of this expense is unnecessary, caused by using inefficient incandescent light bulbs. Only 10 percent of the energy consumed by an incandescent bulb produces light; the remainder is given off as heat. Technologies developed during the last 10 years with fluorescent lighting can help cut lighting costs 30 to 60 percent while enhancing light quality and reducing environmental impacts.

Increasing your lighting efficiency is one of the quickest and easiest ways to decrease your energy bill. If you replace 25 percent of your light bulbs in high-use areas with fluorescents, you can save about 50 percent on your lighting bill. Compact fluorescent light bulbs (CFLs) provide the equivalent amount of bright, attractive light and no longer flicker or buzz. Although CFLs cost more initially, they save money in the long run because they use only one-quarter the energy of an equivalent incandescent bulb and last 8-12 times longer. Each CFL you install can save you $30 to $60 over the life of the bulb.

In a typical home, one compact fluorescent bulb can reduce carbon dioxide emissions by 260 pounds per year. If every American household replaced one of its incandescent light bulbs with a CFL, it would save the same amount of energy as a large nuclear power plant produces in a year.

Appliance Energy Consumption

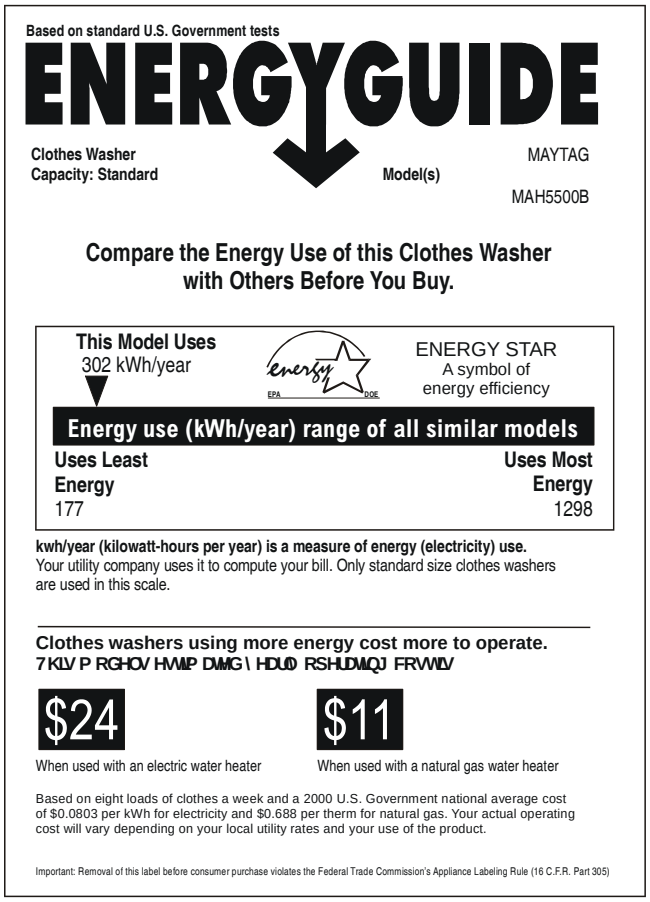
Appliance	Average Yearly Usage in kWh
Color TV	250
Furnace Fan	500
Waterbed Heater	900
VCR	80
Aquarium	600
Computer	130
Clock	25
Toaster	45
TV Cable Box	80
Ceiling Fan	50
Coffee Maker	50
Iron	50
Humidifier	100
Garbage Disposal	20
Window Fan	20
Hot Tub	2300

Water Heating

Water heating is the third largest energy expense in your home. It typically accounts for about 14 percent of your utility bill. Heated water is used for showers, baths, laundry, dishwashing and general cleaning. There are four ways to cut your water heating bills—use less hot water, turn down the thermostat on your water heater, insulate your water heater and pipes, and buy a new, more efficient water heater.

One of the easiest and most practical ways to cut the cost of heating water is to simply reduce the amount of hot water used. In most cases, this can be done with little or no initial cost and only minor changes in lifestyle. A family of four, each showering for five minutes a day, uses 700 gallons of water a week. You can cut that amount in half simply by using low-flow, non-aerating showerheads and faucets. Other ways to conserve hot water include taking showers instead of baths, taking shorter showers, fixing leaks in faucets and pipes, and using the lowest temperature wash and rinse settings on clothes washers.

Most water heater thermostats are set much higher than necessary. Lowering the temperature setting on your water heater can save energy. Every ten-degree reduction of the thermostat can create energy savings of 3-5 percent. A new, energy-efficient water heater can save $200 or more annually in water-heating costs. A solar water-heating system can save up to $350 a year.



Based on standard U.S. Government tests

ENERGYGUIDE

Clothes Washer
Capacity: Standard

Model(s) MAYTAG MAH5500B

Compare the Energy Use of this Clothes Washer with Others Before You Buy.

This Model Uses 302 kWh/year

ENERGY STAR
A symbol of energy efficiency

Energy use (kWh/year) range of all similar models

Uses Least Energy	Uses Most Energy
177	1298

kwh/year (kilowatt-hours per year) is a measure of energy (electricity) use.
Your utility company uses it to compute your bill. Only standard size clothes washers are used in this scale.

Clothes washers using more energy cost more to operate.
7KLV P RGHOV HVWLP DWHG \ HDUO RSHUDWLQJ FRVWV

$24 When used with an electric water heater

$11 When used with a natural gas water heater

Based on eight loads of clothes a week and a 2000 U.S. Government national average cost of $0.0803 per kWh for electricity and $0.688 per therm for natural gas. Your actual operating cost will vary depending on your local utility rates and your use of the product.

Important: Removal of this label before consumer purchase violates the Federal Trade Commission's Appliance Labeling Rule (16 C.F.R. Part 305)

TRANSPORTATION

Americans own one third of the world's automobiles. The transportation sector of the U.S. economy accounts for over 27 percent of total energy consumption and 67 percent of petroleum consumption each year. America is a country on the move; we love the freedom provided by our vehicles.

The average American uses 500 gallons of gasoline every year, driving each vehicle about 12,000 miles. At $2 per gallon, that equals $1,000 in fuel costs alone. The number of miles we drive each year is predicted to increase by 40 percent during the next 20 years if we don't change our behavior by using public transportation, carpooling, walking or bicycling.

Most people must use a personal vehicle, too; the key is to use it wisely. When you are on the road, you can achieve 10 percent fuel savings by improving your driving habits and keeping your car properly maintained. Here are behaviors that increase fuel economy:

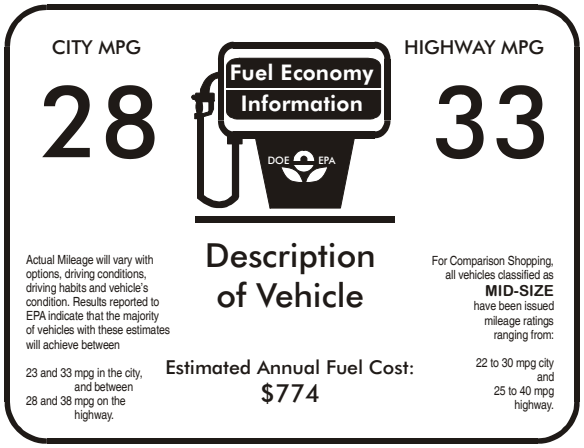
- Combine errands into one trip.
- Turn the engine off rather than letting it idle for more than a minute.
- Have your car serviced as described in the maintenance booklet.
- Keep tires inflated to recommended pressures.
- Anticipate traffic stops.

Here are behaviors that lower fuel economy:

- Quick acceleration.
- Traveling at high speeds. Traveling at 65 mph instead of 55 mph lowers fuel economy by 15 percent.
- Carrying unnecessary weight in the vehicle.
- Revving the engine.
- Operating the vehicle with the suspension out of alignment or with the wheels and tires out of balance.
- Using electrical accessories that require high amperage when they are not needed.

Improvements in the average fuel economy of new cars and light trucks from the mid-1970s through the mid-1980s were significant. The average fuel economy of cars almost doubled in that time period and for trucks it increased by more than 50 percent. These improvements were due mainly to the Corporate Average Fuel Economy (CAFE) standards enacted in 1975. The standards were met largely through cost-effective technologies such as engine efficiency improvements and weight reduction, not downsizing. The safety and environmental performance of new vehicles improved along with fuel efficiency during this period.

Unfortunately, the average fuel economy of new passenger vehicles declined from a high of about 26 miles per gallon (mpg) in 1988 to less than 24 mpg in 1999 due to increased vehicle size and horsepower, the rising market share of sport utility vehicles (SUVs) and trucks, and the lack of more stringent regulations.



Today, 50 percent of new passenger vehicles are SUVs and light trucks that do not have to meet high fuel economy standards. The U.S. imports almost two-thirds of the oil we use. Our dependence on foreign oil could be almost completely eliminated if the average fuel economy of vehicles were 45 mpg instead of 25 mpg.

When buying a vehicle, significant savings can be achieved by selecting a fuel-efficient model. All new cars must display a mileage performance label, or Fuel Economy Label, that lists estimated miles per gallon for both city and highway driving.

Compare the fuel economy ratings of the vehicles you are considering and make mpg's a priority. Over the life of the vehicle, you can save thousands of dollars and significantly improve air quality.

INDUSTRY

Manufacturing the goods we use every day consumes an enormous amount of energy. The industrial sector of the U.S. economy consumes one-third of the nation's total energy demand.

In the industrial sector, energy efficiency and conservation measures are not driven so much by consumers as by the market. Manufacturers know that they must keep their costs as low as possible to compete in the global economy. Since energy is one of the biggest costs in many industries, manufacturers must use energy efficient technologies and conservation measures to be successful. Their demand for energy efficient equipment has driven much of the research and development of new technologies in the last decades as energy prices have fluctuated.

Individual consumers can, however, have an effect on industrial energy consumption through the product choices we make and what we do with packaging and the products we no longer use.

A Consumer Society

Not only is America a consumer society, it is also a 'throw away' society. America produces almost twice as much solid waste as any other developed country; the average citizen produces more than 1,000 pounds of trash each year.

The most effective way for consumers to help reduce the amount of energy consumed by the industrial sector is to decrease the amount of unnecessary products produced, and to reuse items in their original form wherever possible. Purchasing only those items that are necessary, and reusing and recycling products wherever possible can significantly reduce energy use in the industrial sector.

The 3 Rs of an energy-wise consumer are easy to put into practice. Reducing waste saves money, energy and natural resources, and helps protect the environment.

Reduce

Buy only what you need. Purchasing fewer goods means less to throw away. It also results in fewer goods being produced and less energy being used in the manufacturing process. Buying goods with minimal packaging also reduces the amount of waste generated and the amount of energy used.

Reuse

Buy products that can be used repeatedly. If you buy things that can be reused rather than disposable items that are used once and thrown away, you will save natural resources. You'll also save the energy used to make them, and reduce the amount of landfill space needed to contain the waste. Savings also result when you buy things that are durable. They may cost more initially, but they last a long time and don't need to be replaced often, saving money and energy.

Recycle

Make it a priority to recycle all materials that you can. Using recycled material as the feedstock for manufacturing almost always consumes less energy than using virgin (raw) materials. Reprocessing used materials reduces energy needs for mining, refining, and many other manufacturing processes.

Recycling a pound of steel saves 5,450 BTUs of energy, enough to light a 60-watt bulb for 26 hours. Recycling a ton of glass saves the equivalent of nine gallons of fuel oil. Recycling aluminum cans saves 95 percent of the energy required to produce aluminum from bauxite. Recycling paper cuts energy usage in half.

ENERGY SUSTAINABILITY

Efficiency and conservation are key components of energy **sustainability**—the concept that every generation should meet their energy needs without compromising the energy needs of future generations. Energy sustainability focuses on long-term energy strategies and policies that ensure adequate energy to meet today's needs, as well as tomorrow's.

Sustainability also includes investing in research and development of advanced technologies for producing conventional energy sources, promoting the use of alternative energy sources, and encouraging sound environmental policies.